MER 2003 Landing Sites– Impact Crater Lake and Hydrothermal Deposits

Horton Newsom,

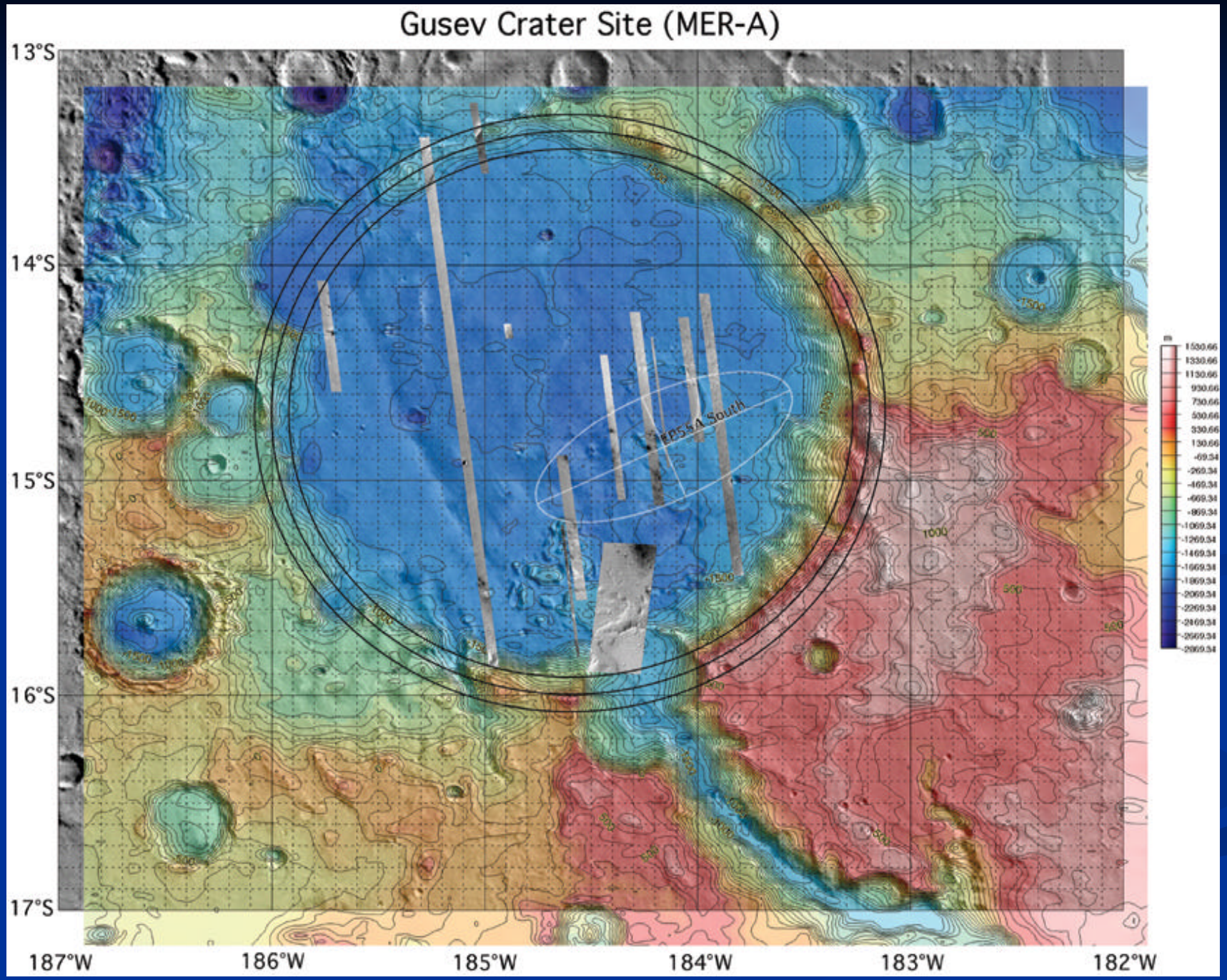
Charles Barber, Ivan Thorsos

Institute of Meteoritics, Dept. of Earth and Planetary Sciences, University of New Mexico

and Ashley Davies, Jet Propulsion Laboratory

Method

- Determine craters that could contribute material to the landing sites.
- Obtain crater diameters using GIS.
- Determine hydrothermal potential for candidate craters.
- For superimposed craters calculate ejecta contributions to landing site ellipses.
- Determine fluvial contributions to landing site ellipses if applicable.


Gusev Crater Site (MER-A)
13°S
14°S
15°S
16°S
17°S
187°W
186°W
185°W
184°W
183°W
182°W
MER-A South
m

Hydrothermal deposits in Gusev

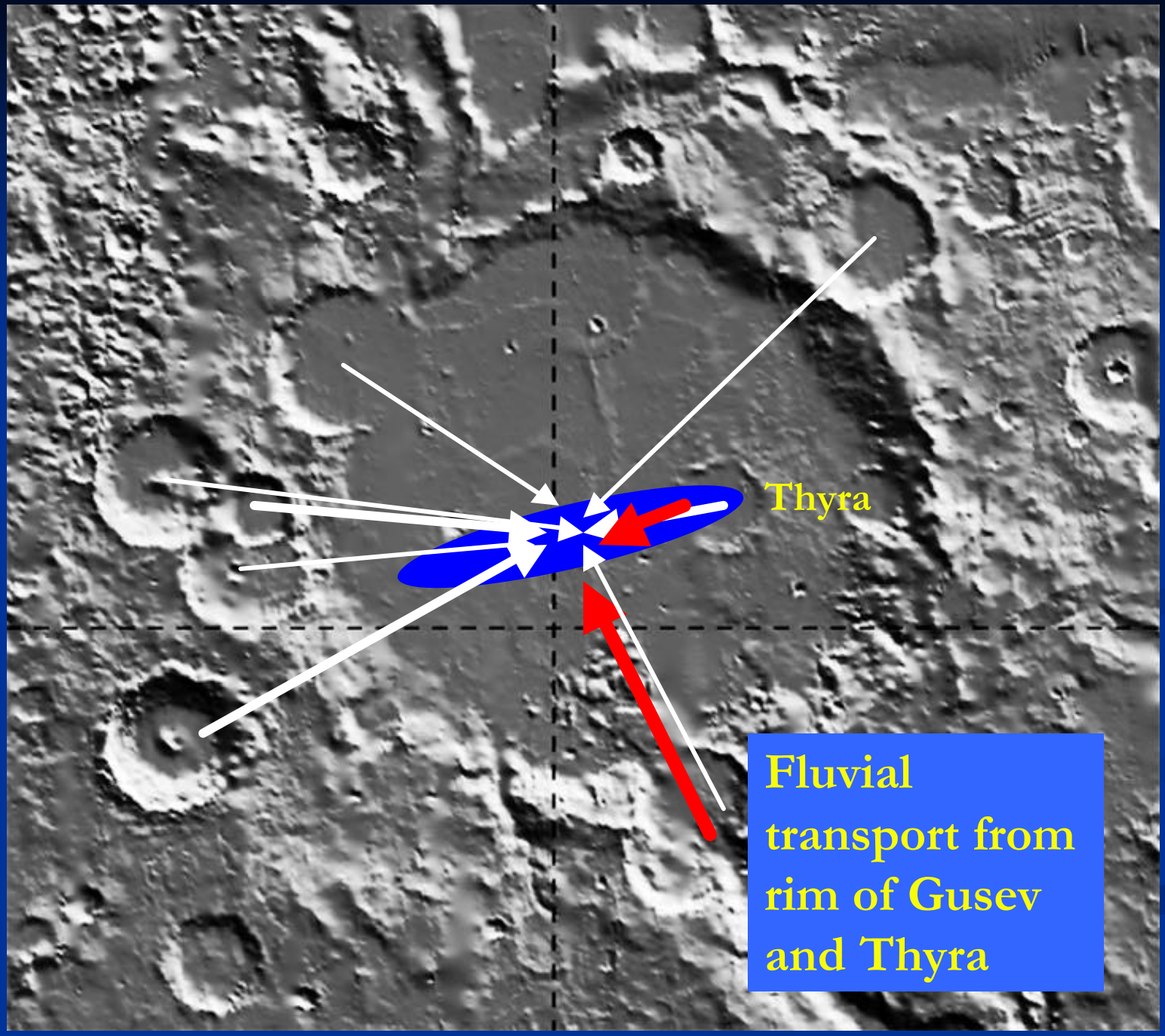
Gusev 158 km diam., melt - 10,000 km^3

Thyra 21 km diam., melt - 140 km^3

Gusev heat equivalent to 57 times Yellowstone over 15,000 years

- **Ellipse contains Gusev rim material ejected from large superimposed craters including Thyra (but material is probably buried).**
- **Hydrothermal deposits are probably exposed on the rim of Thyra, inside of ellipse.**
- **Gusev rim material was probably transported to the ellipse by late fluvial processes.**

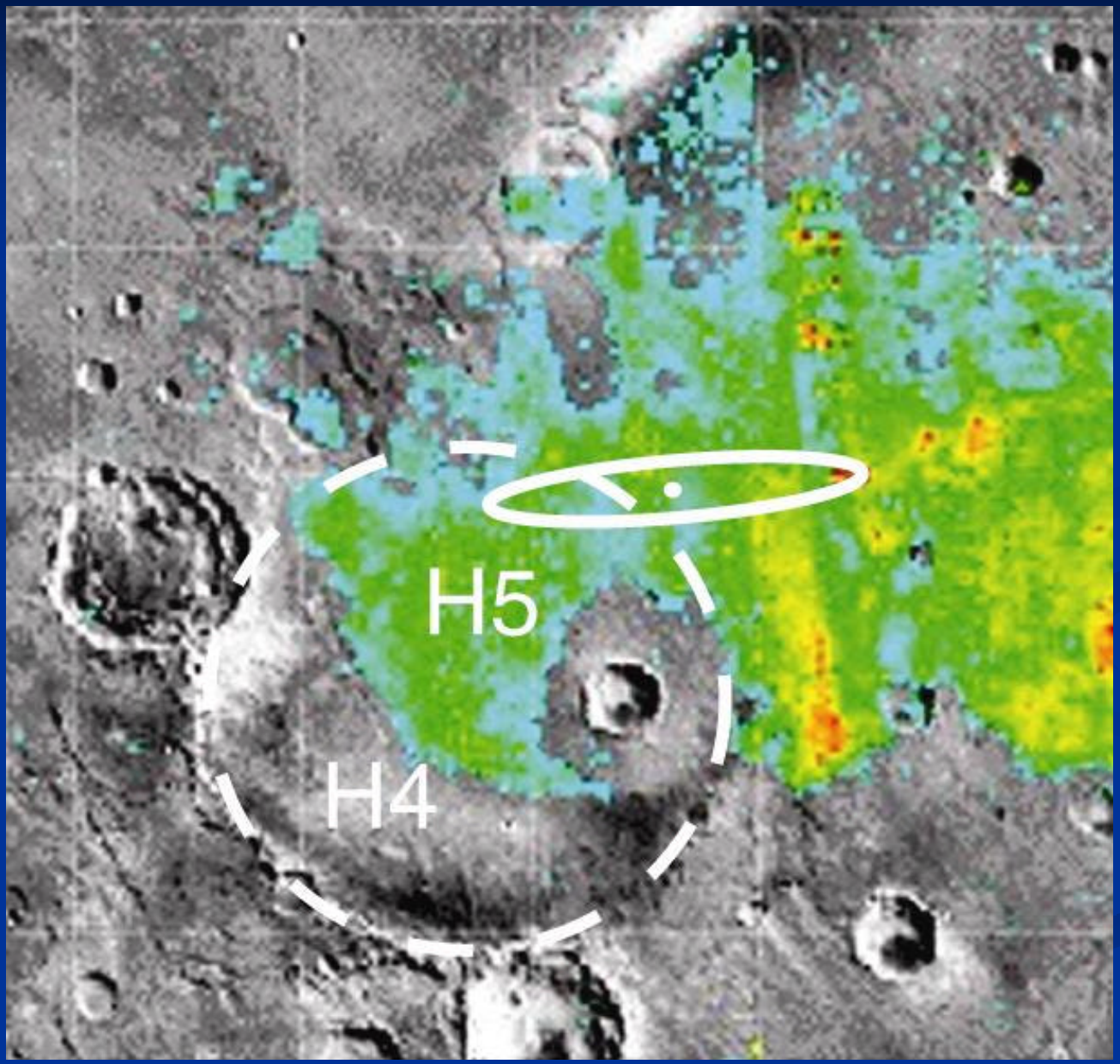
MOLA Shaded Relief



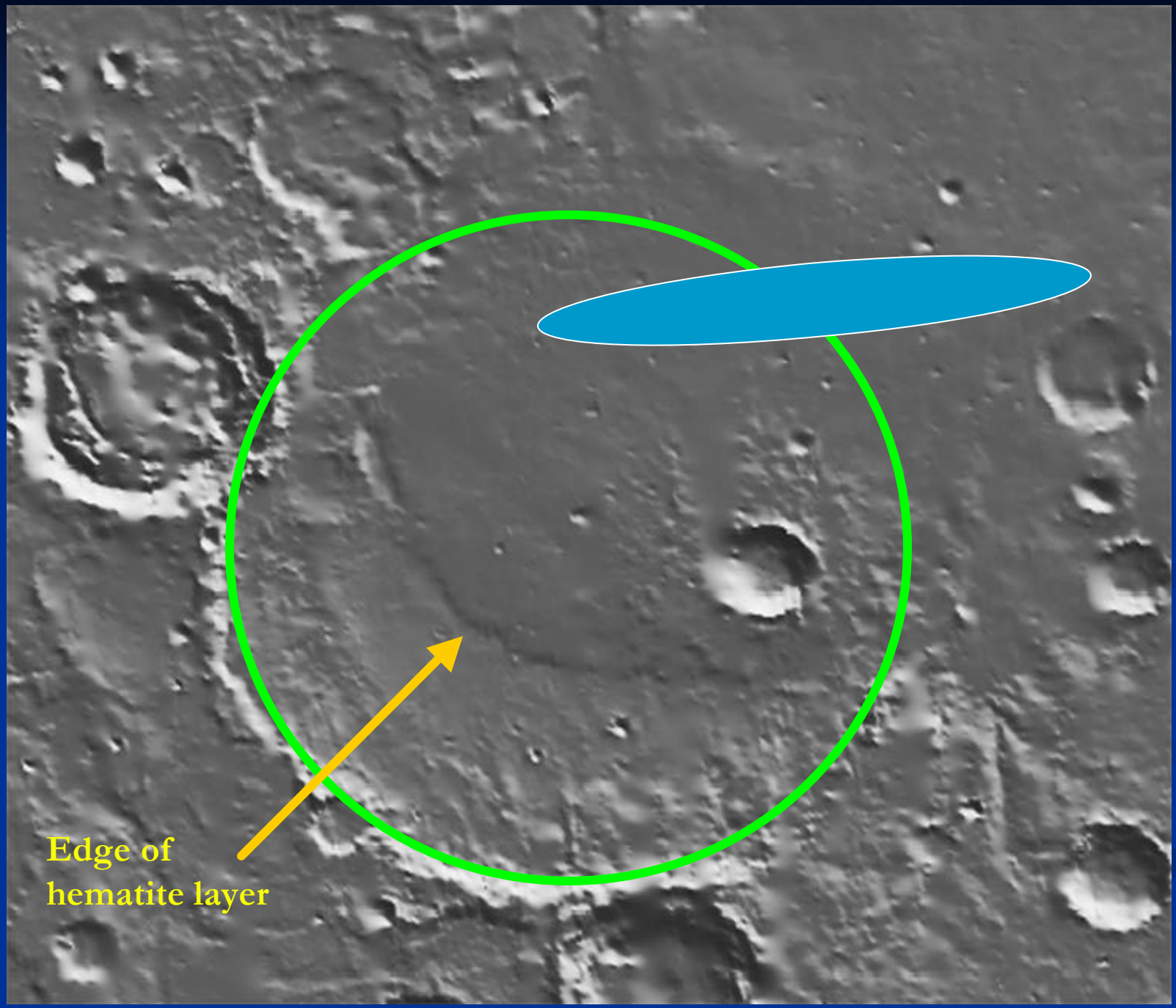
Transport of Material from Thyra to MER Landing Site

- Distance from center of landing site to Thyra's rim is only 21 km.
- Greater than 200 meter difference in elevation from the rim of Thyra down to the landing site allows for possible fluvial transport of material.

Hematite site

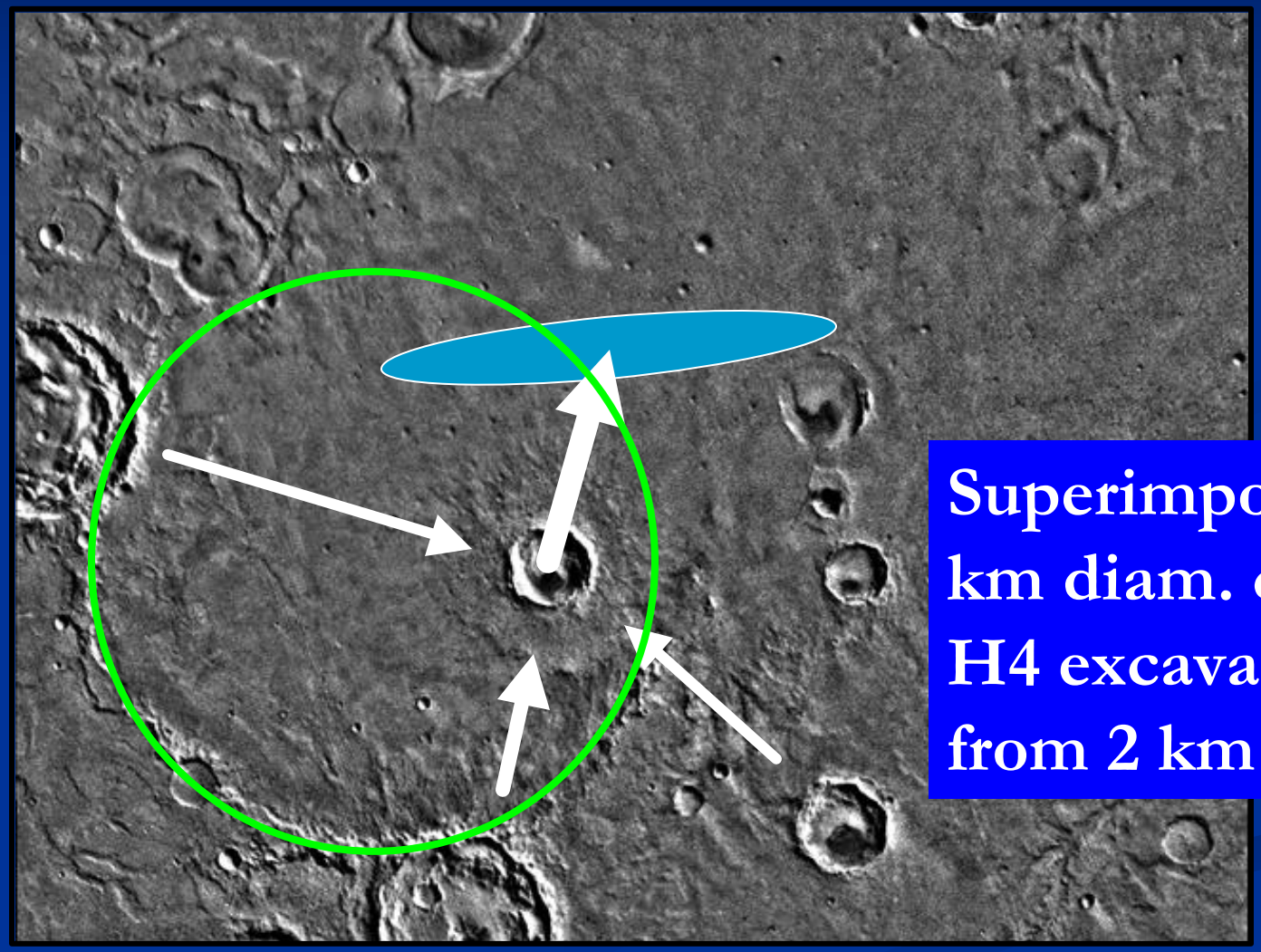


MOLA Shaded Relief

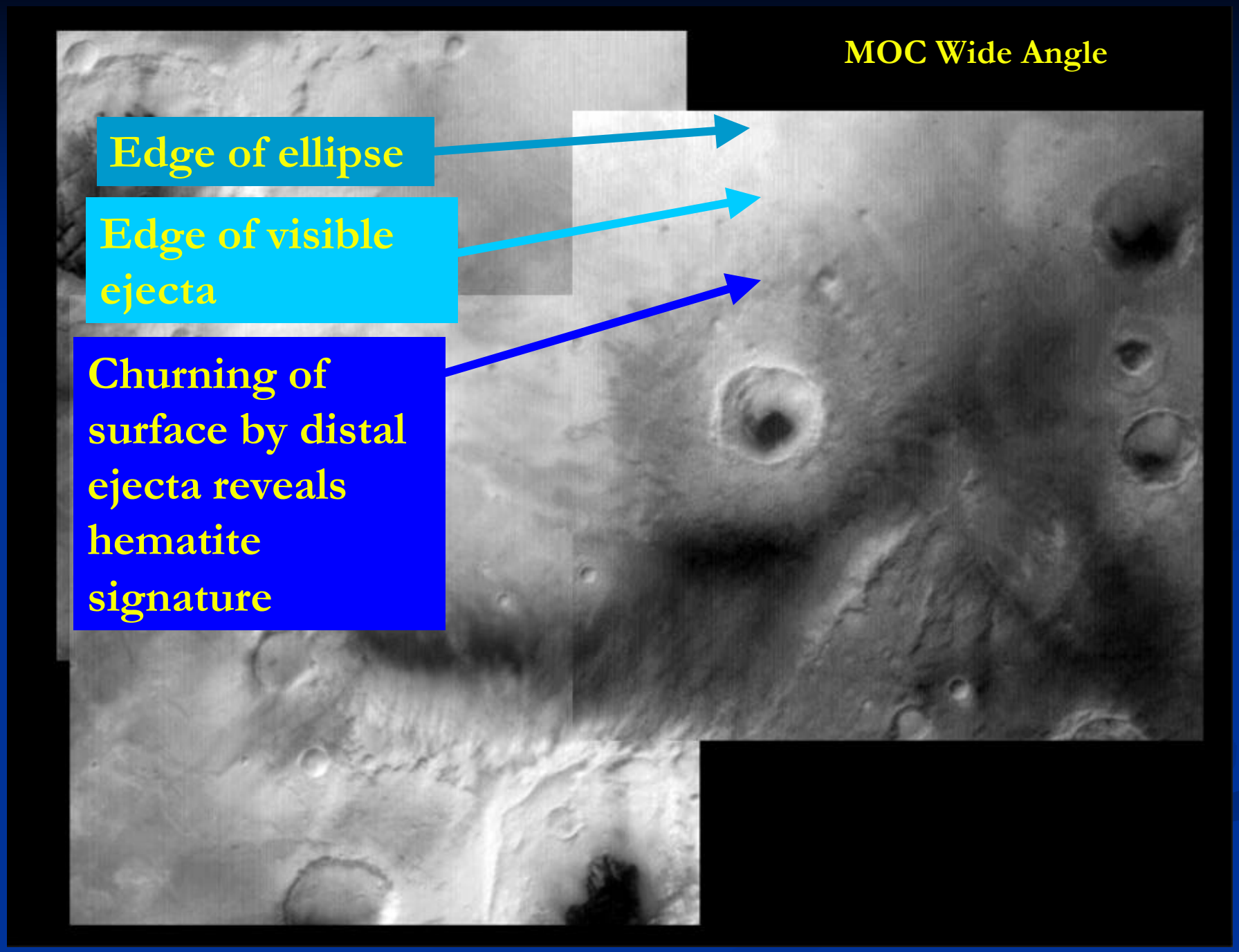


Ejecta transport

Viking
MDIM



Superimposed 19 km diam. crater H4 excavates from 2 km depth


MOC Wide Angle
Edge of ellipse
Edge of visible ejecta
Churning of surface by distal ejecta reveals hematite signature

Hydrothermal deposits in Hematite site

H4 140 km diam., melt - 7,000 km^3
Heat equivalent to 38 times Yellowstone over 15,000 years

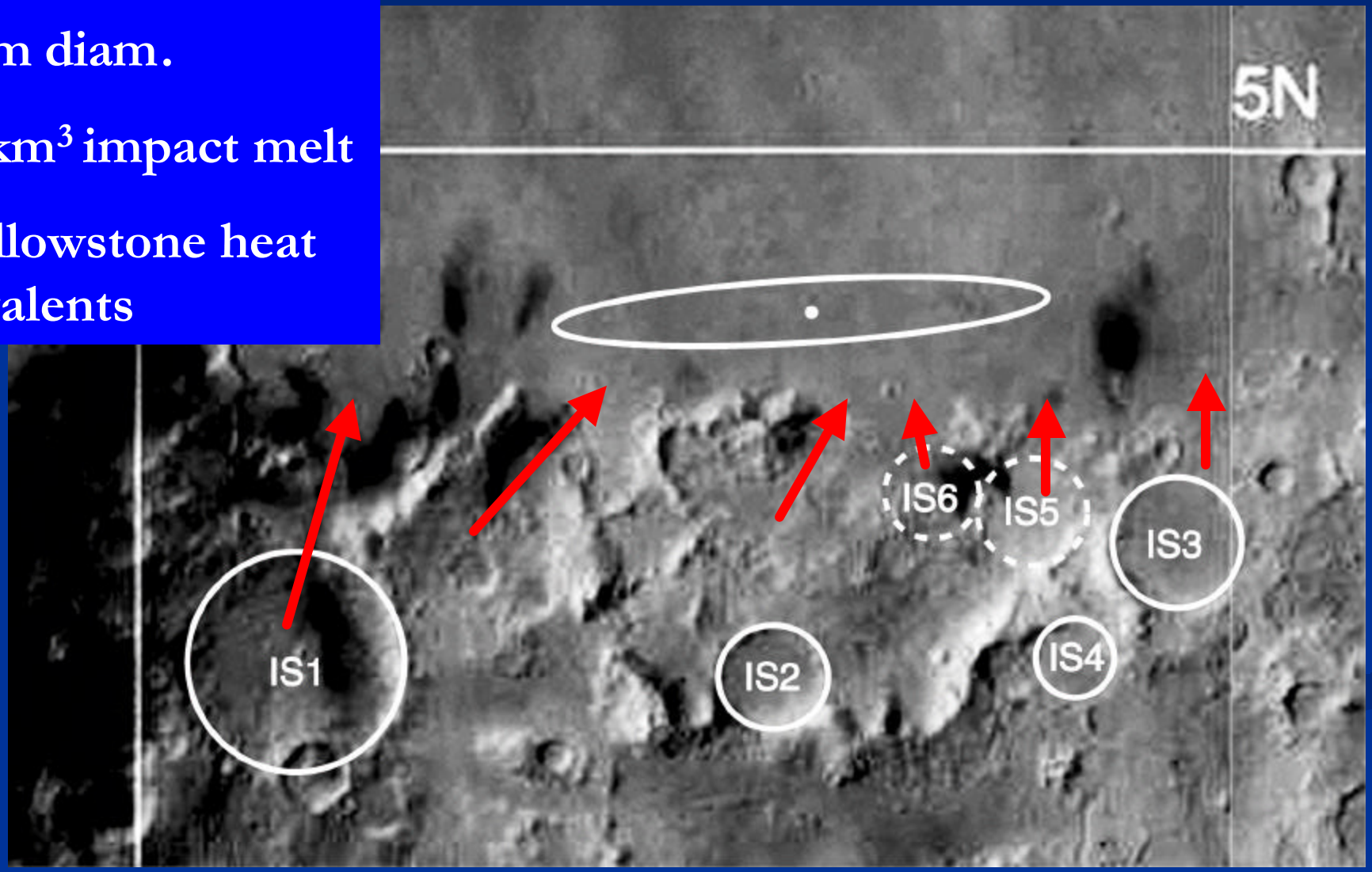
- **Center of ellipse contains 20 to 40 cm of ejecta from superimposed 19 km diam. H5, including:**
  - **Impact melt from H4**
  - **Lake deposits in H4 (gravity -75 mgal, Yuan)**
  - **H4 rim material transported to H5 site by earlier superimposed craters.**

Isidis landing site: upstream craters

IS1 Crater

- 60 km diam.
- 500 km^3 impact melt
- 3 Yellowstone heat equivalents

Courtesy L. Crumpler



Conclusions – Lacustrine and Hydrothermal deposits

- Lacustrine:
  - Gusev (most likely) in surface layers
  - Hematite site- in ejecta blanket of 19 km crater?
  - Isidis - very unlikely
- Hydrothermal:
  - Hematite site (most likely) in ejecta blanket of 19 km crater
  - Gusev – on rim of Thyra and in fluvial deposits
  - Isidis – in fluvial deposits?

TES Thermal Inertia on Geolines